Transition of EAP material from novelty to practical applications – are we there yet?

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For many years, electroactive polymers (EAP) received a relatively little attention due to their limited actuation capability and the small number of available materials. As reported in this book, there are now new EAP materials that exhibit large displacement response to electrical stimulation and they are enabling great potentials for the field. EAP are very attractive for their operational similarity to biological muscles, particularly their resilience, damage tolerant, and ability to induce large actuation strains (stretching, contracting or bending). The application of these materials as actuators to drive various manipulation, mobility and robotic devices involves multidiscipline including materials, chemistry, electromechanics, computers, electronics, etc. Even though the force actuation of existing EAP materials and their robustness require further improvement, there has already been a series of reported successes. The successful devices that were reported include miniature manipulation devices including catheter steering element, miniature manipulator, dust-wiper, miniature robotic arm, gripper and others. The field of EAP has enormous potential to many areas and, judging from the range of inquiries that this book editor has received in recent years, it seems that almost any aspect of human life can be impacted. While some of the considered applications may be science fiction it is important to scope the requirements to the level that current materials can address. Using EAP to replace existing actuators may be a difficult challenge and therefore it is highly desirable to identify a niche application where it would not need to compete with existing capabilities. This paper will review the current efforts and the expectations for the future.